



**Ball Aerospace  
& Technologies Corp.**

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Reply to: P. O. Box 1062, Boulder, CO 80306-1062

9 October 2003  
Defsys.03.SMF.042

Northrop Grumman Corporation  
Space Technology  
One Space Park, M/S R10/2077G  
Redondo Beach, CA 90278

Attention: Ms. Fayda Ayache  
Subcontracts Manager

Subject: Request to Disclose OMPS Related Data

Reference: Subcontract 64584DDQ2S

In accordance with referenced subcontract Ball Aerospace respectfully requests your authorization for Ball Aerospace to present OMPS related data at the SPIE Defense & Security Symposium on 12-14 April 2004 in Orlando Florida. This specific request is for the attached abstract "*End-to-End Modeling of the Ozone Mapping and Profiling Suite*". If this abstract is selected, we will submit another request for the paper.

The abstract is due no later than 1 FEB 2004. Please contact me at 303/939-4373 or e-mail at [sflahert@ball.com](mailto:sflahert@ball.com) if I can provide any additional information.

Sincerely,

A handwritten signature in black ink, appearing to read "Sean Flaherty", with a stylized flourish at the end.

Sean M. Flaherty, CPCM  
Contracts Manager  
Ball Aerospace & Technologies Corp.

# Space & Electronics Clearance Request for Public Release of Information

**NORTHROP GRUMMAN**

## Space Technology

TECHNOLOGY  
CLEARANCE OFFICE ONLY

**ALLOW 3-6 WEEKS FOR  
CUSTOMER/GOVERNMENT  
REVIEW**

- ☒ ABSTRACT /SUMMARY      ☐ MEDIA MATERIALS  
☐ TECHNICAL PAPER      ☐ ADVERTISEMENT  
☐ ORAL PRESENTATION      ☐ BROCHURE  
☐ NEWS RELEASE      ☐ AUDIOVISUAL  
☐ EXHIBIT DISPLAY      ☐ INTERNET MATERIAL

1. AUTHOR(S) <b>Ball Aerospace &amp; Technologies Corp. (BATC)</b>		CCC <b>M294</b>	BLDG <b>R10</b>	MAIL STA <b>2744</b>	PHONE <b>X.46806</b>	PROCESS ORGANIZATION /PROGRAM <b>P&amp;SCM/NPOESS</b>
2. TITLE OF MATERIAL <b>End-to-End Modeling OMPS Instruments.</b>					3. AUTHOR(S) DEADLINE <b>1 FEB 2004</b>	
4. <input type="checkbox"/> COMPANY FUNDED <input type="checkbox"/> NON-GOVERNMENT CONTRACT <input checked="" type="checkbox"/> GOVERNMENT CONTRACT		CLASSIFICATION OF MATERIAL <input checked="" type="checkbox"/> UNCLASSIFIED <input type="checkbox"/> U.S. ONLY <input type="checkbox"/> SECRET			5. SESSION CLASSIFIED    YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> DISTRIBUTE OUTSIDE U.S.?    YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	
6. PURPOSE:    FOR MEETINGS / CONFERENCES LIST NAME, SPONSOR, DATE, LOCATION. FOR PUBLICATIONS, LIST JOURNAL, PUBLISHER, PROPOSED DATE. <b>To allow subject abstract to be submitted to the SPIE Defense and Security Symposium. This will result in a paper to be presented at the SPIE conference on April 12-16, 2004, in Orlando Florida. The paper will be submitted after the abstract is approved.</b>						
7. DOES THE SUBMITTED MATERIAL DESCRIBE AN INVENTION, SOFTWARE OR CONCEPT THAT IS POTENTIALLY PATENTABLE? IF DEVELOPED UNDER IR&D, LIST PROJECT NUMBER:					YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	
8. IF YES TO 7, HAS AN INVENTION DISCLOSURE, FORM 125, BEEN FILED WITH LAW DEPARTMENT? IF ANSWER IS YES, LIST DISCLOSURE DOCKET NUMBER:					YES <input type="checkbox"/> NO <input type="checkbox"/>	
9. WAS ANY WORK DESCRIBED DONE UNDER CONTRACT? (IF SO, COMPLETE 10, 11, AND 12.)					YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
10. CONTRACT NUMBER: <b>F0470-02-C-0502</b> SALES NUMBER: <b>01E163</b>						
11. PROCURING AGENCY / PRIME CONTRACTOR: <b>NPOESS Integrated Program Office (IPO)/Northrop Grumman Space Technology (NGST)</b>						
12. CUSTOMER TECHNICAL MONITOR(S): <b>Lt. Curtis Stutz</b> PHONE NUMBER(S): <b>(301) 713-4783</b>						
13. AUTHOR'S SIGNATURE (SIGNED ON BEHALF OF AUTHOR ) SIGNATURE _____ TYPED NAME: <b>BATC</b> DATE _____						
14. ORGANIZATION/PROGRAM DESIGNEE SIGNATURE _____ TYPED NAME: <b>F. Ricker or Designee</b> DATE _____				15. BUSINESS DEVELOPMENT (REQUIRED FOR NEWS RELEASES AND ADVERTISEMENTS ONLY) SIGNATURE _____ TYPED NAME: _____                      DATE _____		
16. LAW DEPARTMENT (REQUIRED IF ANSWER TO 7 OR 8 ABOVE IS "YES") SIGNATURE _____ TYPED NAME: _____                      DATE _____				17. EXPORT (CONFERENCE IS NOT LIMITED TO U.S. PERSONS) SIGNATURE _____ TYPED NAME: <b>BATC</b> DATE _____		
18. SECURITY SIGNATURE _____ TYPED NAME: <b>N. Gimma</b> DATE _____				19. TECHNOLOGY CLEARANCE OFFICE SIGNATURE _____ TYPED NAME: <b>S. L. Cohen</b> DATE _____ CLEARANCE: <input type="checkbox"/> APPROVED <input type="checkbox"/> APPROVED W/AMENDMENTS <input type="checkbox"/> DENIED <input type="checkbox"/> LIMITED APPROVAL		

# Space & Electronics Clearance Request for Public Release of Information

***NORTHROP GRUMMAN***

*Space Technology*

20. INSTRUCTIONS / REMARKS

Concurrence:

Nann Gimma  
NPOESS Security Manager

**Subject:** Motaghedi OR05

**Title:** End-to-End Modeling of the Ozone Mapping and Profiling Suite

**Authors:** Brian K. McComas<sup>a</sup>, Carter Wright<sup>a</sup>, Quinn Remund<sup>a</sup>, Jack Larsen<sup>b</sup>, Colin Seftor<sup>b</sup>, Erica Raine<sup>c</sup>

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**Presentation Type:** Oral

**Abstract:**

The Ozone and Mapping Profiling Suite (OMPS) is an instrument suite in the National Polar-orbiting Operation Environmental Satellite System (NPOESS). The OMPS instrument is designed to globally retrieve both total column ozone and ozone profiles. To do this, OMPS consists of three sensors, two Nadir instruments and one Limb Instrument. Each OMPS sensor has an End-to-End Model (ETEM) developed using the Toolkit for Remote Sensing, Analysis, Design, Evaluation, and Simulation (TRADES), a Ball Aerospace proprietary set of software tools developed in Matlab™. The ETEM activities have three fundamental objectives: sensor performance validation, aid in algorithm development, and algorithm robustness validation. The ETEM activities are key to showing sensor performance meets the system level Environmental Data Record (EDR) requirements. To do this, the ETEM incorporates sensor data; including point spread functions, stray light, dispersion, bandpass, and focal plane array (FPA) noise parameters. The sensor model characteristics are first implemented with predictions and updated as component test data becomes available. To evaluate the system's EDR performance, the input radiance derived from the forward ozone model is entered into the ETEM, which outputs a simulated image. The algorithms process the simulated image to determine the ozone amount. The system level EDR performance is determined by

comparing the retrieved ozone amount with the truth, which was entered into the forward model. Additionally, the ETEM aids the algorithm development by simulating the expected sensor and calibration data with the expected noise characteristics. Finally, the algorithm robustness can be validated against extreme conditions using the ETEM.

**Keywords:** end-to-end modeling, system modeling, ozone retrieval modeling

**Bibliography for Brian K. McComas:**

Dr. Brian McComas is employed by Ball Aerospace & Technologies Corp. where he manages the Integrated Modeling and Simulation Lab. He has over ten years experience modeling advanced electro-optical systems. He developed the end-to-end system the Limb Sensor on the Ozone Mapping and Profiler Suite. He completed his PhD in Electrical Engineering at the University of Colorado, Boulder in 2002.